

NON-PUBLIC?: N  
ACCESSION #: 9208110304  
LICENSEE EVENT REPORT (LER)

FACILITY NAME: St. Lucie Unit 2 PAGE: 1 OF 04

DOCKET NUMBER: 05000389

TITLE: Reactor trip from 100% power on (Loss of Load) caused by a design inadequacy in the on-line testing modification of the turbine trip control system

EVENT DATE: 07/10/92 LER #: 92-005-00 REPORT DATE: 08/07/92

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:  
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: Scott W. Sienkiewicz, Shift TELEPHONE: (407) 465-3550  
Technical Advisor

COMPONENT FAILURE DESCRIPTION:

CAUSE: SYSTEM: COMPONENT: MANUFACTURER:  
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On July 10, 1992 at 1018 hours with St. Lucie Unit 2 in mode 1 at 100% power, the reactor automatically tripped on loss of load while performing turbine trip valve tests. Prior to the trip, Operations personnel were testing turbine trip valve 20/ET using recently installed on-line testing circuitry. This new on-line testing circuitry was installed during the 1992 refueling outage due to the failure of the turbine to trip following a manual reactor trip (Reference LER # 389-92-001-00)

The root cause of the reactor trip was a design inadequacy which failed to accurately predict the sharp pressure transient that occurred. A contributing factor is that the post modification testing did not detect the pressure transient. This design inadequacy was contributed to, by the lack of experience in the industry with regard to on-line testing of

the turbine trip solenoid valves. The cause of the trip was an unforeseen and previously undetected pressure transient imposed on the turbine generator hydraulic control oil system during on-line testing.

Corrective Actions for this event: 1) The on-line testing of the turbine trip solenoid valves (20/ET, 20-1/OPC, 20-2/OPC) has been suspended. 2) Testing of the "Loss of Load" trip signal was conducted while Unit 2 was shutdown due to the trip. The results of the testing validated the cause of this event as described in this LER. 3) Further evaluation of the solenoid valve test modifications will be performed prior to the next Unit 1 refueling outage. 4) Pre-installation testing will be performed for the Unit 1 solenoid valve test modifications. 5) Unit 1 post modification testing will be performed prior to start up, utilizing the lessons learned from Unit 2. 6) Perform the same solenoid valve test modifications on Unit 2, during the next scheduled refueling outage.

END OF ABSTRACT

TEXT PAGE 2 OF 04

#### DESCRIPTION OF THE EVENT

New on-line testing circuitry was installed during the 1992 refueling outage due to the failure of the turbine to automatically trip following a manual reactor trip (Reference LER# 389-92-001-01). During that event, St. Lucie Unit 2 turbine generator (EIIIS:TA) failed to trip due to unrelated and undetected failures in the two redundant and electrically independent automatic turbine tripping schemes. Undetected turbine trip mechanism failures of this type have been recognized as an industry problem. Because of the St. Lucie Unit 2 turbine trip failure, a modification to the turbine trip control system was designed in-house and installed during the outage to enhance system reliability, by permitting on-line testing of the turbine solenoid devices. The modification (shown on figure # 1) was intended to allow functional testing of the solenoid trip devices located in the hydraulic control circuit of the main turbines steam admission valves (current industry not provide for on-line testing of these solenoid valves). The modification was considered state-of-the-art and the turbine vendor was consulted during the design process. Prior to the trip, plant personnel tested turbine the solenoid devices in accordance with an approved post modification test procedure. This was done before unit startup, and no deficiencies were identified.

On July 10, 1992 at 1018 hours with St. Lucie Unit 2 in mode 1 at 1000% power, the reactor automatically tripped on Loss of Load while performing turbine trip solenoid device tests using newly installed on-line testing circuitry. The sequence for testing this valve (see figure #1) and the

subsequent trip is as follows:

- 1) 20/ET test block outlet isolation valve was closed.
- 2) Per the procedure the pressure gauge was verified as having no indicated pressure.
- 3) Valve 20/ET was opened.
- 4) When valve 20/ET was opened, it induced a pressure transient which was picked up by the Loss of Load Reactor Protection System (RPS) pressure switches due to their close proximity to valve 20/ET.
- 5) The RPS tripped the reactor on Loss of Load which subsequently tripped the turbine.

## CAUSE OF THE EVENT

The cause of the subsequent reactor trip was an unforeseen and previously undetected pressure transient imposed on the turbine generator hydraulic control oil system during on-line turbine trip testing with the modification installed. The pressure transient had not been identified during extensive post modification testing and was not detectable with the normally installed instrumentation. Sensitive test instrumentation revealed a very rapid 0.020 second pressure transient which interacted with the Reactor Protection System pressure switches that are activated above 150% power. The pressure pulse was most probably caused by filling the very small void between 20/ET, outlet isolation valve and the orifice when valve 20/ET was opened. Previous design experience had not suggested such a phenomenon, and the reactor trip occurred the first time the modification was tested above 15% power.

In summary the root cause of the reactor trip was design inadequacy. The lack of experience in the industry in regard to on-line testing of the turbine trip solenoid valves contributed to the design inadequacy. A contributing factor is that the post modification testing did not detect the pressure transient.

TEXT PAGE 3 OF 04

## ANALYSIS OF THE EVENT

This event is reportable under 10CFR 50.73.a.2.iv as "any event or condition that resulted in manual or automatic actuation of any engineered safety feature, including the reactor protection system."

The event was observed to be an uncomplicated reactor trip on Loss of Load. The Loss of Load reactor trip is for equipment protection and is not required for reactor safety. The resulting transient was well enveloped by the St. Lucie Unit 2 Final Updated Safety Analysis Report section 15.3.2.2 "Loss of Offsite Power". The plant response was much

more conservative than that described in the FSAR for several reasons.

1) Offsite power was not lost. 2) RCS temperatures did not go above normal operating temperatures because the Steam Bypass Control System operated post trip. All plant safety functions were met and there were no additional complications. The Auxiliary Feedwater Actuation System functioned as required during this event. The plant response during the reactor trip was observed to be normal for the given conditions. Consequently, the health and safety of the public were not affected by this event.

#### CORRECTIVE ACTIONS

1) The on-line testing of the turbine trip solenoid valves (20 /ET, 20-1/OPC, 20-2/OPC) has been suspended.

2) Testing of the "Loss of Load" trip signal was conducted while Unit 2 was shutdown due to the trip. The results of the testing validated the cause of this event as described in this LER.

3) Further evaluation of the solenoid valve test modifications will be performed prior to the next Unit 1 refueling outage.

4) Pre-installation testing will be performed for the Unit 1 solenoid valve test modifications.

5) Unit 1 post modification testing will be performed prior to start up, utilizing the lessons learned from Unit 2.

6) Perform the same solenoid valve test modifications on Unit 2, during the next scheduled refueling outage.

#### ADDITIONAL INFORMATION

Affected Component Identification

None

Previous Similar Event

None

TEXT PAGE 4 OF 04

Figure 1 "Turbine Trip Solenoid Valve Maintenance / Test Block" omitted.

ATTACHMENT 1 TO 9208110304 PAGE 1 OF 1

P.O. Box 128, Ft. Pierce, FL 34954-0128

August 7, 1992  
FPL

L-92-210  
10 CFR 50.73

U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, D. C. 20555

Re: St. Lucie Unit 2  
Docket No. 50-389  
Reportable Event: 92-005  
Date of Event: July 10, 1992  
Reactor Trip from 100% power on (Loss of Load)  
caused by a design error in the  
Turbine Trip Testing on-line modification

The attached Licensee Event Report is being submitted pursuant to the requirements of 10 CFR 50.73 to provide notification of the subject event.

Very truly yours,

D. A. Sager  
Vice President  
St. Lucie Plant

DAS/JWH/kw

Attachment

cc: Stewart D. Ebnetter, Regional Administrator, USNRC Region II  
Senior Resident Inspector, USNRC, St. Lucie Plant

DAS/PSL #738-92

an FPL Group company

\*\*\* END OF DOCUMENT \*\*\*

---